

masses of foam, both by Desch and by the writer are also in agreement. There is an essential difference in the behaviour of foams, however, since the spheres of foam are more mobile, are capable of greater movement and deformation and of subdivision, and are more sharply dependent upon surface tension. It is very likely, though, from the large number which approach pentagonal symmetry that the normal packing is pentagonal. The fact that no rhombic dodecahedral foam cells are noted substantiates the ideas of Kelvin, but it is also true that every instance of rhombic dodecahedral twelve-point packing must result in the formation of cuboctahedral cells in a foam. The relative scarcity of cells of this form further argues as to the greater stability of the pentagonal dodecahedral packing. The foam cells behave to a remarkable degree like rigid spheres, even to an appreciable deviation from the theoretical angle of stability demonstrated by Plateau in his study of foam films on a wire framework.

The case of metals especially concerned in the work of Desch is a little harder to understand. The coincidence of the pentagonal structure of the granular metal with that of foam is apparently a substantiation of the Quincke hypothesis. In a homogeneous cooling metal-fusion one would expect the solidification outward from nuclei in a spherical front, and in ideal cases, wherein the temperature was homogeneously distributed, these nuclei might be expected to be very equally spaced. Except by means of the foam hypothesis of Quincke, it is difficult to account for the preference shown for a pentagonal packing.

The calcite oolites examined in the Idaho lot are without doubt selected, ideally perfect examples which may represent the concentration of hundreds or thousands of less perfect or variously bounded individuals. Their form is of extreme interest and it is highly desirable that the locality be visited and a large number of these unusual forms collected as well as studied in place. The explanation of their form above set forth seems the most rational one to fit the facts of the case, but further study of the problem would seem to be highly desirable.

PALEONTOLOGY.—*The generic characters of Astartella Hall.*<sup>1</sup>  
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by J. B. REESIDE, JR.)

The genus *Astartella* was established by James Hall in 1858. The only species referred to it at that time was *A. vera* which consequently

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is the genotype. The original description, which is very brief, runs as follows:

Shell bivalve, thick, smooth or concentrically furrowed: lunule impressed; ligament external; hinge teeth two in each valve, the anterior tooth of the right valve large and strong, with a longitudinal pit in the summit. Related to *Astarte*.

This diagnosis has, so far as I am aware, never been revised or rewritten up to the present time; yet on attempting to verify it from specimens in my collection I found it far from complete and in some respects inaccurate.

The astartellas are one of the commonest pelecypods of our Pennsylvanian faunas and if we except a few species which appear to be isolated because perhaps they are rare, but which may be brought into close relationship when more is known about them, all the species or at least all the more common species are pretty much alike. In any collection of considerable size several species might be distinguished on selected specimens, all of them, however, connected by other specimens of intermediate character. With the astartellas, then, the question is not whether they represent more than a single genus so much as whether they represent more than a single species. The specimens upon which my observations were made therefore unquestionably belong to Hall's genus. I have identified them with *Astartella concentrica* Conrad although it is by no means certain that Conrad's species and the type species of *Astartella* are not the same. *Astartella concentrica* had been in the literature some fifteen years when *A. vera* was described, but it was cited under the genus *Nuculites* and was evidently unknown to Hall.

Although shells of this type constitute one of the most common of Pennsylvanian pelecypods, they rarely show characters of prime generic importance. If they are not actually broken in that part, the hinge margin is liable to be covered by hard rock. Or, as often happens, thanks to the hinge teeth and perhaps also to the marginal denticles, the two valves occur together so that one of them is concealed by the other. To be sure, the shape of these shells is in a measure characteristic and also the sculpture of widely spaced concentric lamellae, although Hall in the original description does say—I suspect with an eye to the off chance—that the shell is smooth or concentrically furrowed. In further comment upon his diagnosis, the right valve is the only one whose interior was figured by Hall and, if

judgment is permitted from certain expressions used, it was the only one known to him. It seems doubtful, as will be shown later, whether either valve actually does have two "hinge teeth," by which expression it is fairly certain Hall meant cardinal teeth.

The hinge teeth, as just remarked, are rarely to be seen in these shells, but one of the other generic characters, the "external ligament" (or at least its receptacle), is a conspicuous feature in any specimen that is even fairly well preserved. By that designation Hall undoubtedly had in mind a sharply defined bevelled surface behind the beaks which corresponds to a similar though smaller surface anterior to them which Hall calls the "lunule." On most specimens these two structures show no material difference except in size, and when I have had occasion to refer to the posterior one I have called it an escutcheon. The same term was employed by Meek in describing *Astartella newberryi*. It may actually have been a ligamental area as Hall considered it; nevertheless, my specimens seem to show another structure on the interior of the shell which was apparently a place of ligamental attachment, and although this fact, even if established, might not necessarily prove that the external structure did not also function in the ligamental equipment, it would tend to discredit Hall's interpretation.

Hall's description, I believe, was predicated largely if not wholly upon the right valve. In my collection left valves showing the hinge are decidedly more numerous than right valves. They show that this valve was equipped with a single prominent cardinal tooth which had a large, deep pit or socket on the anterior side. On the posterior side the cardinal tooth is confluent with a thickening of the hinge margin or sort of hinge plate from which it rises considerably, but by no means as much or as abruptly as it rises from the deeply excavated socket in front of it. The shell on the anterior side of the socket is as high and prominent as the cardinal tooth itself; it is probably to be considered a lateral tooth, though it is merely the shell margin which as it recedes, forms the broad, sharply defined lunule.

The hinge structure of the right valve, as already noted, is not shown by as many specimens as the left valve, but it is shown very well indeed by one of them. This specimen has a single large wedge-shaped cardinal tooth that is flat on top and slightly indented by two longitudinal grooves. The tooth has a deep triangular socket on the posterior side; on the anterior side it descends vertically, but not quite so far, and is continuous with a narrow shelf-like projection that is carried forward almost to the anterior extremity of the shell.



This, the anterior prolongation of the hinge-plate, is guarded on its outer or upper side by the thin, strongly projecting edge of the escutcheon, and as its inner edge also is elevated, a short groove is inclosed between them.

But little difficulty is experienced in correlating the structures of the two valves. The flat-topped denticle in the right valve evidently fits into the deep pit that is anterior to the cardinal tooth of the left valve, while the cardinal tooth of the left valve is received by the deep pit that is posterior to the cardinal tooth of the right valve. Thus I recognize but a single cardinal tooth in each valve instead of two. Nevertheless, it is possible to harmonize my observations in some measure with those of Hall, for a slight prominence exists posterior to the socket of the right valve where Hall has figured a posterior cardinal tooth. His figure, however, is not accurate; at least it is not in accord with my observations, and I should hardly regard this elevation as being a tooth. The structure in this part is peculiar and will be considered more in detail farther on. Hall's figure shows two other structures that are really important, although, inasmuch as he did not have the left valve to compare them with, he failed to recognize their significance. His figure shows, though not clearly, a groove passing down the anterior side of the shell margin for a short distance. Actually, as has just been described, this margin is thickened into a narrow shelf that extends forward almost to the anterior extremity, and this shelf-like structure bears a groove along its upper surface by reason of its raised margins. Hall's figure also shows quite clearly a projecting lamina back of the beak which is really the margin of the shell along what he calls the ligamental area.

The construction of the left valve is just the reverse of this for the shell is thickened along the posterior margin of the hinge line and grooved to receive the sharp and projecting edge of the right valve, while the shell margin in front of the beak is, as already described, sharp and projecting so as to fit into the groove of the right valve corresponding to it. Whether this reciprocating structure of the two valves would properly be called teeth, I am not sure. In each case one "tooth" seems to be merely the shell margin and not an independent structure comparable to the cardinal teeth.

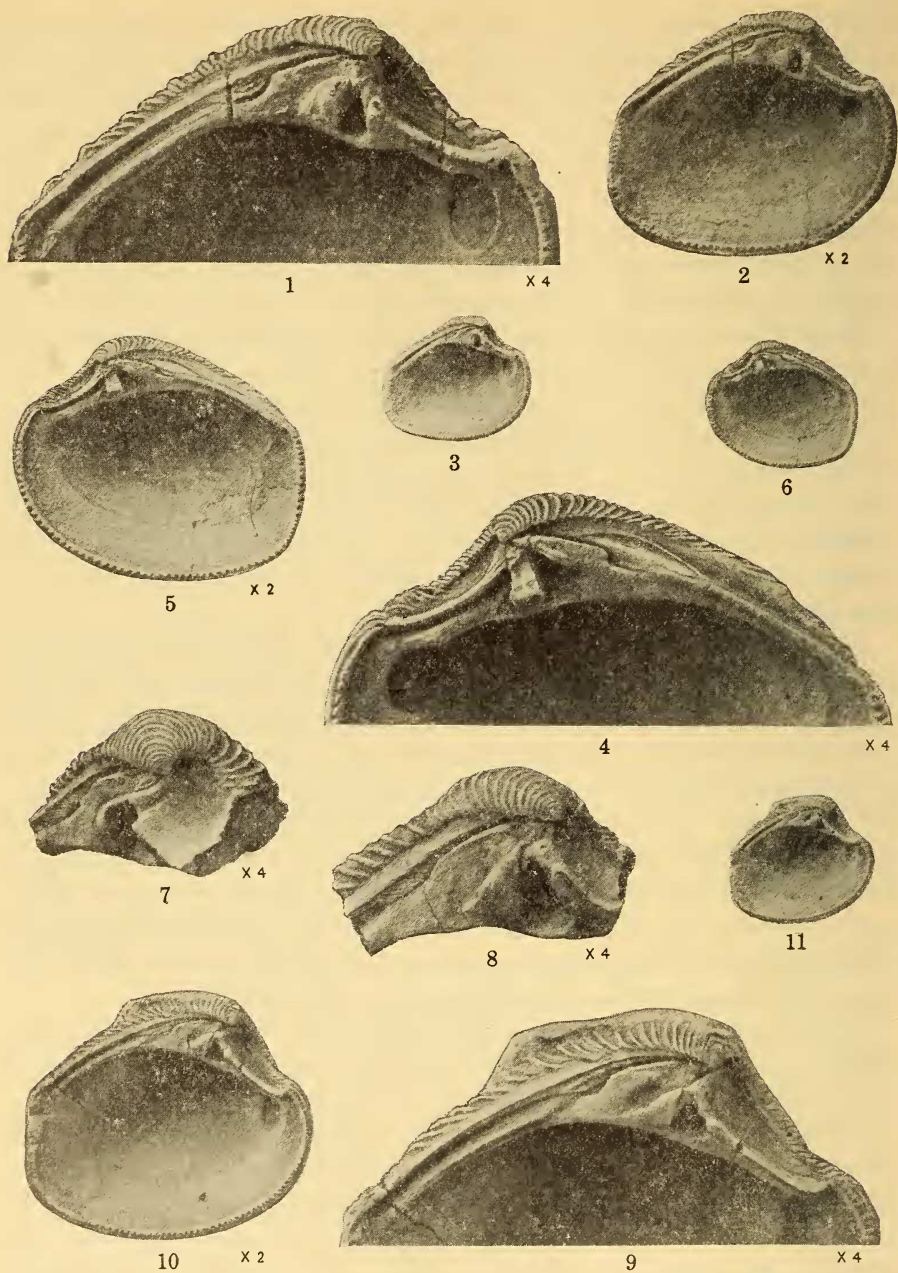
I must now try to make clear the singular construction of the hinge where in the right valve Hall thought he recognized a posterior cardinal tooth. At this point there is constructed a flat-lying plate approximately parallel to the hinge plate proper, but free above and connected with it only at the lower side. This plate incloses a very

narrow, very deep cleft or crack as if part of the shell had been incompletely sawed off from above. In other language, this structure begins as a narrow groove under the beak which rapidly becomes deeper though not broader so as to detach from above a laminar projection that lies almost flat and is but slightly separated from the main body of the hinge plate. To the reader the thought would probably suggest itself that this is some appearance due to accident, but it is very clearly shown and is quite persistent on both valves and in a number of specimens. This plate helps to form what appears to be a receptacle for the ligament, for there is a well-defined striated area partly underneath the plate and partly visible beyond it on the posterior side which I would say was a place of ligamental attachment. The lower boundary of this ligamental area was a continuation of the lower margin of the lamina where it joins the hinge plate; the upper boundary is a distinct angular ridge which forms the lower margin of the escutcheon. Posteriorly this ligamental area narrows strongly from below upward, giving place to the structure which may be called the posterior lateral tooth.

The somewhat remarkable structure which I have tried to describe must, I think, be a place of ligamental attachment. It can have nothing to do with dentition though a slight elevation of the surface more or less incidental to it was apparently identified by Hall as a posterior cardinal tooth. In this respect the two valves are alike and the lamellæ could not possibly have interlocked. In so far as one may venture the word, this structure must have served for the attachment either of a muscle or of a ligament, and one can scarcely question that it was for the latter. As I have already remarked, this would not preclude the interpretation of the "escutcheon" as a ligamental area, but it would render the interpretation less probable.

The escutcheon also begins under the umbo above the ligamental groove. It regularly widens posteriorly but is sharply defined below by a ridge and is distinctly an external character.

One more feature, somewhat trivial perhaps, may be mentioned. The dental socket does not itself extend to the umbo, but it is represented upon the plane of the lunule by a triangular structure similar in appearance to the pseudodeltidium of certain brachiopods and formed apparently by shell that filled in (or possibly overarched) the socket as the tooth of the other valve moved forward or was worn off at the upper end. This structure is sharply defined by grooves and is convex, especially on the posterior side. It may be concave on the anterior.



Figures 1-11, *Astartella concentrica* Conrad. 1-3, left valve,  $\times 4$ ,  $\times 2$ , and  $\times 1$ . 4-6, right valve,  $\times 4$ ,  $\times 2$ , and  $\times 1$ . 7, fragment of a left valve tilted to show the covering of the dental socket and its track,  $\times 4$ . 8, another fragment of a left valve,  $\times 4$ . 9-11, left valve,  $\times 4$ ,  $\times 2$ , and  $\times 1$ .

Lawrence shale, Iatan and St. Joseph, Missouri.



To summarize the structure of this genus as shown by my specimens, each valve has a single large cardinal tooth, the cardinal tooth of the right valve being anterior to that of the left valve when the two valves were joined. The left valve, consequently, has a deep pit or socket on the anterior side of the tooth, while the right valve has a socket on the posterior side of the tooth. In addition the anterior part of the cardinal margin in the left valve forms a linear tooth that is received by a groove in the thickened anterior margin of the right valve. On the other hand, the posterior part of the cardinal margin in the right valve forms a linear tooth that rests in a groove in the thick posterior margin of the left valve corresponding to it. Between the cardinal tooth and the posterior tooth in each valve is an area of ligamental attachment partly inclosed by a leaflike plate which is continuous below with the main hinge structure. The sharply defined areas on the exterior of the shell are lunule and escutcheon, although the posterior one may have housed a ligament as Hall originally thought.

The muscular imprints consist of a rather large, deep, and sharply defined scar at the anterior extremity of the shell, and another somewhat larger, but less deep and less sharply defined, opposite to it on the posterior superior angle. The pallial line connecting these imprints is indistinct in all the specimens seen, but it appears to be without a sinus, as indeed, has generally been believed. A short distance back of the upper margin of the anterior scar and excavated in the underside of the hinge plate is a small but rather deep pedal scar.

BOTANY.—*New passionflowers from South America and Mexico.*<sup>1</sup>  
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In preparing a revision of American Passifloraceae the writer has had the opportunity of examining the collections of several herbaria in the United States and Europe. As this revision will not be ready for publication for some time the new species recently noted are here described in advance. Photographs of the type specimens in other herbaria are deposited in the United States National Herbarium.

*Passiflora stellata* Moritz, sp. nov.

Stem slender, subtriangular, striate, finely pilosulous; stipules setaceous, 5 mm. long; petioles up to 3 cm. long, biglandular at base of blade, the glands 0.5 mm. long; leaves 4 to 6.5 cm. long, 4 to 8 cm. wide, 3-lobed about

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